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***Aphelocheirus* (s.str.) *freitagii* nov.sp. from Mindoro Island and additional notes on Philippine Aphelocheiridae (Heteroptera)**

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A b s t r a c t : *Aphelocheirus* (s.str.) *freitagii* nov.sp. is described from Oriental Mindoro, the Philippines. It belongs to the *A. minor* species group and is closely related to two other Philippine endemics, *A. palawanensis* POLHEMUS & POLHEMUS 1989 and *A. zamboanga* POLHEMUS & POLHEMUS 1989. Distribution data from Luzon are given for further four species of *Aphelocheirus*.

K e y w o r d s : Heteroptera, Aphelocheiridae, *Aphelocheirus*, *Aphelocheirus minor* species group, new species, new records, Mindoro, Luzon, Philippines, endemism.

Introduction

The only genus of Aphelocheiridae, *Aphelocheirus* WESTWOOD 1833 is distributed in the Old World and inhabits fast flowing sections of streams and rivers. Its highest diversity has been documented from Southeast Asia. The Philippine aphelocheirid fauna has been treated by USINGER (1938), POLHEMUS & POLHEMUS (1989) and ZETTEL (1998, 1999, 2003). ZETTEL (1999) recognized eight species and two subspecies, all of them endemic in the Philippines, and presented a key. This study reports the discovery of *Aphelocheirus* on the island of Mindoro in 2010, which is a small surprise as this island was targeted for water bug inventory research since 1992 for several times.

Material and methods

Specimens were killed in ethyl-acetate, dried and glued on squared card boards. Genitalia of three males, and subgenital plates of two females were dissected and glued on the same card board with the specimen. The holotype of *A. freitagii* nov.sp. is deposited in the Museum of Natural History, University of the Philippines, Los Baños, paratypes and material of other species are in the same institution, in the Natural History Museum Vienna, and in the senior author's collection (if not mentioned otherwise in the text).

Terminology follows earlier papers by the senior author. Descriptions were prepared using a Nikon SMZ 1500 binocular microscope, for line drawings (Figs 2-11) a camera lucida was used. The stacked photograph (Fig. 1) was taken with a Leica DFC490 camera attached to a Leica MZ16 binocular microscope with the help of Leica Application Suite V3 and processed with CombineZM and Adobe Photoshop 7.0 software.

For comparison, voucher specimens in the collection of the Natural History Museum Vienna were used, which contains most described taxa of the *Aphelocheirus minor* species group except *A. breviculus* NIESER & CHEN 1991.

***Aphelocheirus* (s.str.) *freitagii* nov.sp. (Abb. 1-12)**

E t y m o l o g y : This species is dedicated to Dr. Hendrik Freitag, De La Salle University, Manila, recognising his outstanding contributions to the knowledge of Philippine freshwater arthropods.

T y p e m a t e r i a l : Holotype (brachypterous male) and paratypes (3 brachypterous males, 3 brachypterous females) labelled "Philippines: Oriental Mindoro\Victoria, Malayas, Malayas\ River, 21.2.2010, leg.\ C. Pangantihon (P347)".

D i a g n o s i s : Medium-sized species with yellow head and distinct yellow marks on sides of pronotum and abdominal tergites (Fig. 1); with hardly incised hind corners of pronotum and narrow gap between hemielytra of brachypterous morph. Parameres of male fitting the general shape of the *A. minor* group, left paramere relatively wide near apex (Figs 5-7), right paramere distally subparallel and weakly curved (Figs 8-10). Sub-genital plate (Fig. 11) of female with small, but distinct posteromedial lobe, pair of long setae posterolaterally, and paired tufts of short setae subapically.

D e s c r i p t i o n o f b r a c h y p t e r o u s m a l e : Size: Body length 8.6-9.1 mm (holotype: 9.1 mm), maximum width 5.2-5.7 mm (holotype: 5.6 mm). Pronotum width 4.2-4.5 mm (holotype: 4.4 mm).

Colour (Fig. 1): Dorsum mostly dark brown, with distinct yellow marks. Head yellow. Pronotum with small paired marks near midline and large marks at hind corners. Mesoscutellum and hemielytra usually dark, variably marked with light brown areas. Tergites laterally with distinct yellow patches at hind corners. Venter chiefly dark brown, except head, pygophore and hind corners of abdominal segments yellow. Antennae, rostrum and legs yellow.

Structures (measurements refer to holotype): Dorsum dull. Head (Fig. 1) relatively short, total length 0.8 times width, length of anterior part in front of eyes 0.65 times eye length, dorsal surface with mixture of large and small, densely set punctures, narrow intervals shiny. Pronotum, mesoscutellum and hemielytra (Fig. 1) coriaceous and dull. Pronotal length measured along midline 0.8 times head width, maximum width 3.7 times medial length; lateral margins strongly converging anteriorly, hind corners very shallowly emarginated; disk only slightly convex, hardly separated from flat lateral areas. Mesoscutellum, width 3.0 times length. Hemielytra rather large, just not reaching hind margin of tergite 2, with narrow gap (ca. 0.05-0.15 times total hemielytron width). Hemielytron, length 0.7 times width; embolar process small, its width ca. 0.1 times hemielytron width. Tergites finely coriaceous, with some transverse wrinkles. Posterior corners of connexivum 2 approximately right-angled, of connexiva 3-6 acute. Segment 7 short.

Venter: Rostrum relatively short, reaching middle of mesocoxae, 1.5 times as long as the basally thickened profemur. Legs stout, without specialised fields of setae. Mesofemur not, metafemur slightly surpassing sides of body. Propleural process (Fig. 2) very short. Mesosternum (Fig. 3) with highly raised carina in posterior three fourths, posterior face steep. Metasternum short, rhomboidal. Abdomen asymmetrical; hind margins of sternites 3 and 4 with hardly developed medial tips. All sternites without peg-like setae.

Genitalia: Pygophore (Fig. 4) ovate; left parandrium clearly longer and slightly wider than right. Sclerotized main portion of aedeagus (Fig. 4) basally wide, distally slender, and apically curved. Left paramere (Figs 5-7) relatively short and broad, subapically slightly widened, apex subtriangular and slightly rounded, external face with numerous microsetae, without long setae; microsculpture indistinctly and only locally developed. Right paramere (Figs 8-10) slender, distally parallel-sided, apically rounded, only with few scattered microsetae, without long pilosity.

Description of brachypterous female: Size: Body length 8.7-9.0 mm, maximum width 5.3-5.5 mm. Pronotum width 4.2-4.3 mm.

Colour as in male. Most structures similar to male. Gap between hemielytra up to 0.2 times hemielytron width. Abdomen symmetrical. Subgenital plate (sternite 7; Fig. 11) with distinct medial lobe at hind margin, with concave posterolateral margins, with weakly developed paired subapical tufts of short setae (completely rubbed off in one specimen but sockets still recognizable), and with pair of single long setae posterolaterally (occasionally broken off).

Macropterous morphs: Unknown.

Comparative notes: *Aphelocheirus freitagi* nov.sp. belongs to the diverse subgenus *Aphelocheirus* s.str. and therein to the *A. minor* species group as defined by ZETTEL & al. (2008), although the head is slightly longer, the forewings of the brachypterous morph slightly smaller, and the medial part of the female's subgenital plate lobe-shaped and more pronounced than in other group members. This group comprises another nine species (ZETTEL & al. 2008, ZETTEL 2009): *A. nepalensis* ZETTEL 1998 and *A. pradhanai* ZETTEL 1998 from the Himalayas; *A. gusenleitneri* ZETTEL, 2009 from Myanmar; *A. lahu* POLHEMUS & POLHEMUS 1989 from Thailand; *A. minor* POLHEMUS & POLHEMUS 1989, *A. breviculus* and *A. kodadai* ZETTEL 1999 from Borneo; *A. palawanensis* POLHEMUS & POLHEMUS 1989 and *A. zamboanga* POLHEMUS & POLHEMUS 1989 from the Philippines.

A key to Philippine Apheloceridae was published by ZETTEL (1999). *Aphelocheirus freitagi* nov.sp. keys at couplet 11, together with *A. palawanensis* and *A. zamboanga*. Comparing *A. freitagi* with the diagnostic characteristics given for these species, it is distinctly larger (length 8.6-9.1 mm) than *A. palawanensis* (6.4-7.3 mm) and has more strongly rounded anterior corners of the pronotum; and the shape of the right paramere which is broad and weakly curved does not agree with those of both species. The characteristically shaped pronotum of the brachypterous morph (notably its hind corners), the yellow marks on the sides of pronotum and abdominal tergites, the medial lobe and the sparse pilosity of the female's subgenital plate distinguish *A. freitagi* easily from both *A. palawanensis* and *A. zamboanga*. Moreover, in the wide-spread *A. zamboanga*, which has allopatric subspecies in many parts of the Philippines, the reduced forewings meet each other medially, whereas they are separated by a distinct gap in *A. freitagi*.

Habitat and distribution: *Aphelocheirus freitagi* nov.sp. has been collected in the Malayas River at Malayas in the municipality of Victoria. The type locality (13° 09' 26" N 121° 18' 29" E, ca.10 m a.s.l.) is about 1.5 km distant from Lake Naujan (Fig. 13). At the time of collecting, in the dry season, the river (Fig. 12) was about 12 m wide and *Aphelocheirus* was found in shallow water ca. 30 cm deep. *Aphelocheirus freitagi* is found on the substrate in fast current, but only in small patches of a mixture of fine gravel and sand. The surrounding area is agricultural land with

plantations of mango and banana, rice fields and grassland. The collecting site was only partly covered by trees and the river water was turbid. *Aphelocheirus freitagii* was collected together with other rheophilous water bugs (FREITAG & PANGANTIHON, in prep.) including *Asthenocoris luzonensis paradisianus* ZETTEL & NIESER, 1999 (Naucoridae), and, on the water surface, *Rhagovelia potamophila* ZETTEL 1996 (Veliidae) and *Rheumatogonus luzonicus* (KIRKALDY 1909) (Gerridae).

Aphelocheirus freitagii nov.sp. is only known from its type locality on Mindoro. It is almost certainly endemic on this island where it occupies a similar ecological niche as other *Aphelocheirus* minor-group species in southeast Asia, i.e. slightly disturbed habitats. Most species and subspecies of this species group have allopatric distribution. Only in Nepal (*A. nepalensis* and *A. pradhanai*) and on Borneo has sympatry been observed. Nearest to Mindoro are the Palawan archipelago to the southwest and Luzon to the north. Palawan is the home of *A. palawanensis*, and Luzon is inhabited by *Aphelocheirus zamboanga luzonicus* POLHEMUS & POLHEMUS 1989. Comparing the relations of Mindoro's water bug fauna to the faunas of Luzon and Palawan, the island exhibits clearly more affinities to Luzon (e.g. *Limnometra nigripennis* MAYR 1865, *Tenagogonus bergrothi* HUNGERFORD & MATSUDA, 1958 and *Rheumatogonus luzonicus* in Gerridae, *Asthenocoris luzonensis* USINGER 1938 in Naucoridae, *Hydrotrepes stereoides* ZETTEL 2003 in Helotrephidae) than to Palawan (only the gerrid *Metrocoris tenuicornis* ESAKI 1926). This sharp faunal borderline is well known and described as Huxley's Line separating the Palawan archipelago from the other Philippine islands. *Aphelocheirus freitagii* nov.sp. adds to the high number of Mindoro's water bug endemics.

Faunistical notes

Aphelocheirus philippinensis USINGER 1938

Aphelocheirus philippinensis USINGER 1938: 307; POLHEMUS & POLHEMUS 1989: 203; ZETTEL 1999: 114.

Additional material examined: Luzon: 12♂♂, 21♀♀ (brachypterous), 1♂ (macropterous) labelled "Philippinen: Nueva Viscaya\ Santa Fe, Imugan, stream at\ Imugan Falls, 1000m, 6.11.\ 2002, leg. H. Zettel (325)" (vouchers also in Biologiezentrum Linz, Austria and in Coll. Nico Nieser, Tiel, The Netherlands); 2♂♂ (brachypterous) labelled "Philippinen: Nueva Viscaya\ Santa Fe, Barakbak, 620m\ Barakbak Riv., 7.11.2002\ leg. H. Zettel (326)"; 2♂♂, 5♀♀ (brachypterous), 1♂ (macropterous) labelled "Philippinen: Nueva Viscaya\ Santa Fe, Malico, Inacio\ Inacio River, 1200 m, 8.11.\ 2002, leg. H. Zettel (330)"; 3♂♂, 1♀ (brachypterous) labelled "Philippinen: Nueva Viscaya\ Santa Fe, Malico, small\ creek, 8.11.2002\ leg. H. Zettel (332)"; 4♂♂, 5♀♀ (brachypterous) labelled "Philippines: Luzon, Mountain\ Prov., Sagada, Underground Riv.,\ upstream cave, 1450m\ 17°05'N 120°54'E, 13.3.\ 1995, leg. H. Freitag (4)"; 1♂, 1♀ (brachypterous) labelled "Philippines: Luzon, Mountain\ Prov., Sagada, Underground Riv.,\ downstream cave, 1450m\ 17°05'N 120°54'E, 14.3.\ 1995, leg. H. Freitag (5)".

Notes: *Aphelocheirus philippinensis* usually inhabits small and middle-sized, fast flowing streams (POLHEMUS & POLHEMUS 1989, and personal observations). It seems to need cold, clean water and, therefore, strong populations can only be found in areas with forest cover. Regionally, it might have become extinct already – there are no records from Central Luzon since the original description – and generally this species must be regarded as endangered.

D i s t r i b u t i o n : This species is only known from Luzon: Mountain Province, Benguet, Ifugao, Laguna (USINGER 1938, POLHEMUS & POLHEMUS 1989, ZETTEL 1999); first records for Nueva Viscaya Province.

***Aphelocheirus uichancoi* USINGER 1938**

Aphelocheirus uichancoi USINGER 1938: 305; POLHEMUS & POLHEMUS 1989: 205; ZETTEL 1999: 114.

A d d i t i o n a l m a t e r i a l e x a m i n e d : L u z o n : 8♂♂, 8♀♀ (brachypterous), 1♂, 3♀♀ (macropterous) labelled "Philippinen: Nueva Viscaya\ Santa Fe, Imugan, stream at\ Imugan Falls, 1000m, 6.11.\ 2002, leg. H. Zettel (325)"; 2♂♂, 2♀♀ (macropterous) labelled "Philippinen: Nueva Viscaya\ Santa Fe, Malico, Inacio\ Inacio River, 1200 m, 8.11.\ 2002, leg. H. Zettel (330)"; 1♂ (macropterous) labelled "Philippinen: Nueva Viscaya\ Santa Fe, Malico, Dulipay\ River, 8.11.2002\ leg. H. Zettel (331)".

D i s t r i b u t i o n : This species is only known from Luzon: Ifugao, Benguet, Zambales, Cavite, Laguna (USINGER 1938, POLHEMUS & POLHEMUS 1989, ZETTEL 1999); first records for Nueva Viscaya Province.

***Aphelocheirus venus* ZETTEL 1999**

Aphelocheirus venus ZETTEL 1999: 108; ZETTEL 2003: 113.

A d d i t i o n a l m a t e r i a l e x a m i n e d : L u z o n : 1♀ (brachypterous) labelled "Philippinen: Luzon, Cam.\ Sur, Lupi, Sooc, Sooc Riv.\ above dam, 19.-20.3.2003\ Zettel & Pangantihon (349)".

D i s t r i b u t i o n : This species is regionally distributed in southern Luzon (Camarines Sur, Camarines Norte) (ZETTEL 1999, 2003).

***Aphelocheirus zamboanga luzonicus* POLHEMUS & POLHEMUS 1988 (sensu lato)**

Aphelocheirus luzonicus POLHEMUS & POLHEMUS 1988: 212.

Aphelocheirus zamboanga luzonicus: ZETTEL 1999: 116; ZETTEL 2003: 114.

A d d i t i o n a l m a t e r i a l e x a m i n e d : L u z o n : 2♂♂, 4♀♀ (brachypterous) labelled "JCEM 07-003" [Notes taken from collectors' field notes: Philippines, Cagayan, Gonzaga, Barangay Pattao, stream near provincial highway. 18°15.319' N 121°59.226' E. 22.IV.2007, leg. T. Naruse & J.E.C. Mendoza; rocky stream, tributary to large river.] (in Zoological Reference Collection, Singapore); 1♂ (brachypterous) "Philippinen: LZ, Benguet\ Asin Hot Springs\ W Baguio, 17.2.1999\ leg. H. Zettel (180)"; 1♀ (macropterous) "Philippinen: LZ, Mount.Pr.\ Chico River, Gonogon\ 1100 m, 21.2.1999\ leg. F. Seyfert (8a)" (in Coll. F. Seyfert, Vienna); 1♂ (brachypterous), 2♂♂ (macropterous) "Philippinen: Nueva Viscaya\ Santa Fe, Barakbak, 620m\ Barakbak Riv., 7.11.2002\ leg. H. Zettel (326)"; 1♂ (brachypterous) "Philippinen: LZ, Camarines Sur, Lupi, Alanao\ Bahi River, 11.2.2003\ leg. H. Zettel (337)".

N o t e s : The status of this taxon was discussed by ZETTEL (1999). ZETTEL (2003) described the macropterous morph. *Aphelocheirus z. luzonicus* is relatively common in Bicol, but rarely collected in other parts of Luzon. ZETTEL (1999) mentioned an aberrant male from Benguet (see material in this study). The brachypterous male from Nueva Viscaya is also quite different from Bicol material: It is small (body length 7.6 mm) and dorsally blackish except the yellow head and a central yellow mark on the pronotum; and it has short, obtusely rectangular embolar corners and relatively stout parameres. Possible subspecific differentiation in Luzon cannot be done before males from the type locality in Pampanga become known. Consequently, all Luzon specimens are presently summarized under one subspecific taxon, *luzonicus*.

Distribution: Known from Luzon: Pampanga, Cavite, Camarines, Norte, Camarines Sur, Albay, Sorsogon; and from Catanduanes (POLHEMUS & POLHEMUS 1988, ZETTEL 1999, 2003); first records for Mountain Province, Benguet, Cagayan, and Nueva Viscaya Provinces, all in Luzon.

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Zusammenfassung

Eine neue Grundwanzenart, *Aphelocheirus* (s.str.) *freitagii* nov.sp., wird von der Insel Mindoro im Westen der Philippinen beschrieben. Die neue Art gehört in die vom westlichen Himalaja ostwärts bis nach Borneo und den Philippinen verbreitete *A. minor*-Artengruppe und ist mit zwei weiteren philippinischen Endemiten, *A. palawanensis* POLHEMUS & POLHEMUS 1989 und *A. zamboanga* POLHEMUS & POLHEMUS 1989, nahe verwandt. Obwohl Mindoro seit 1992 mehrfach hinsichtlich seiner Wasserwanzenfauna untersucht worden ist, handelt es sich um den Erstfund von Aphelocheiridae auf dieser Insel. Neufunde von vier weiteren *Aphelocheirus*-Arten von der Insel Luzon werden aufgelistet.

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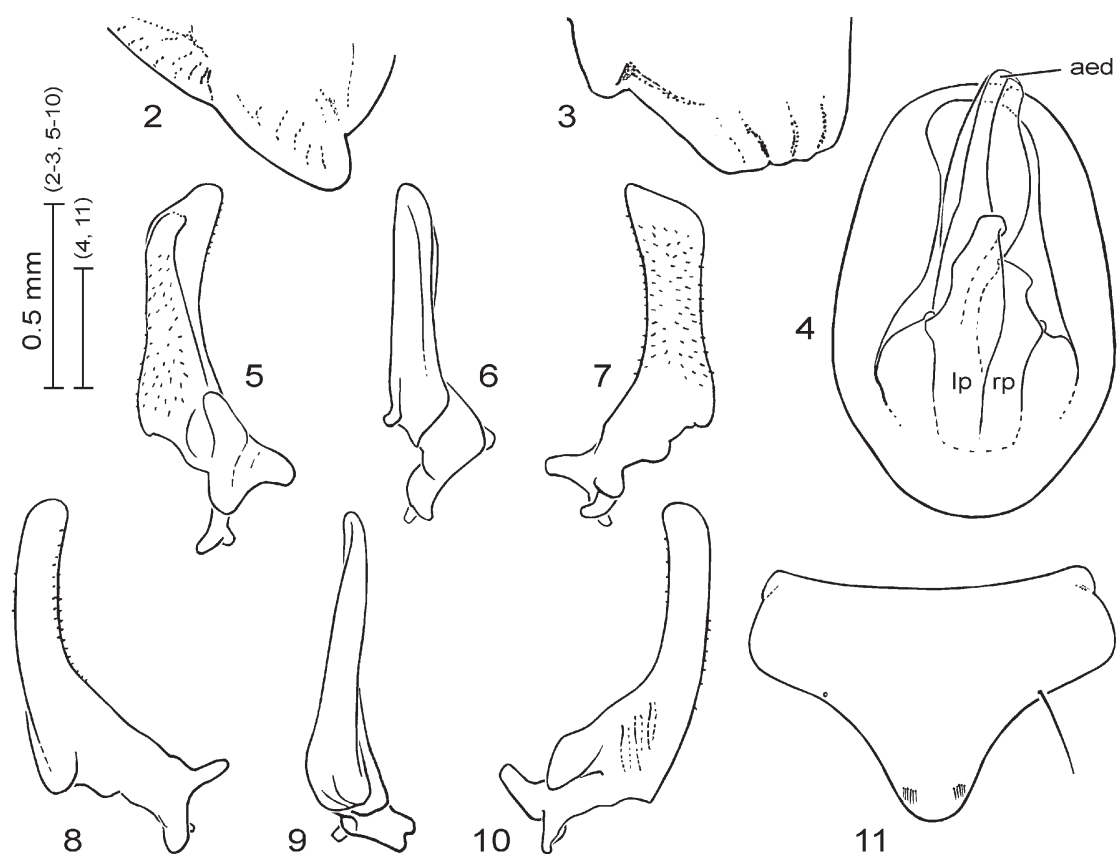
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Fig. 1: *Aphelocheirus* (s.str.) *freitagi* nov.sp., brachypterous male (paratype; body length 9.0 mm), dorsal aspect. Photo: © NHMW Hemiptera Image Collection, printed with permission.



Figs 2-11: *Aphelocheirus* (s.str.) *freitagi* nov.sp. 2-10: brachypterous male; 11: brachypterous female): (2) Propleural process, ventrolateral aspect. (3) Mesosternum, lateral aspect; (4) Pygophore after removal of parameres, with parandria (lp = left parandrium, rp = right parandrium) and aedeagus (aed = main piece of aedeagus, on both sides membranous structures), dorsal aspect. (5-7) Left paramere, three different views. (8-10) Right paramere, three different views. (11) Subgenital plate, ventral aspect.

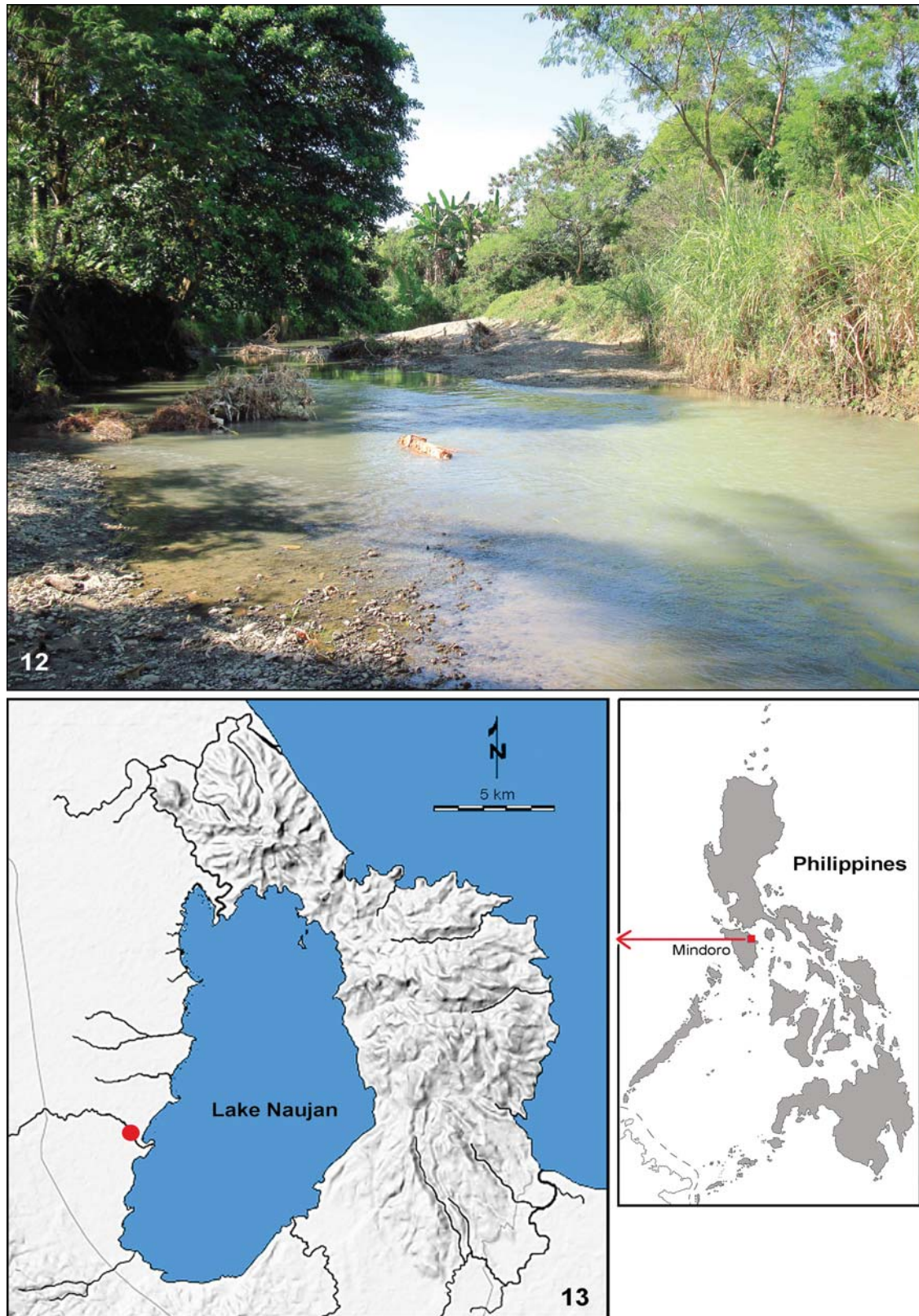


Fig. 12-13: (12) Habitat and (13) type locality of *Aphelocheirus freitagii*. Photo and map: © Hendrik Freitag, printed with permission.